1. 



Frame $S^{\prime}$ moves at $v$ relative to the inertial frame $S$ along the $x$-direction, as shown in the figure. $O$ and $O^{\prime}$ coincide at $t=t^{\prime}=0$. According to the principle of relativity the transformation between $S$ and $S^{\prime}$ obeys

$$
\left\{\begin{array}{l}
x^{\prime}=A(x-v t) \\
x=A\left(x^{\prime}+v t^{\prime}\right) \\
y=y^{\prime}, z=z^{\prime}
\end{array} .\right.
$$

(a) Solve for $t^{\prime}$ and express it in terms of $t$ and $x$.

A light flashes at the origin at $t=0$ and propagates as a spherical wave. The wave front described by observers in $S$ and $S^{\prime}$ is, respectively,

$$
\begin{cases}(c t)^{2}-x^{2}-y^{2}-z^{2}=0 & \text { in } S \\ \left(c t^{\prime}\right)^{2}-x^{\prime 2}-y^{\prime 2}-z^{\prime 2}=0 & \text { in } S^{\prime}\end{cases}
$$

(b) Find $A$.

